MISCELLANEA ZOOLOGICA HUNGARICA
Tomus 9. 1994 p. 11–17

Amphistomes (Trematoda, Amphistomida) of cattle and buffalo in Thailand

by
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(Received April 18, 1994)

Abstract: Examinations aiming at the recovery of amphistomes of cattle and buffalo in Thailand have revealed ten species belonging to the families Gastrothylacidae: *Gastrothylax crumenifer* (Creplin, 1847), *Carmyerius spatiosus* (Brandes, 1898), *Fischoederius elongatus* (Poirier, 1883) and Paramphistomidae: *Orthocoelium streptocoelium* (Fischoeder, 1901), *Orthocoelium dicranocoelium* (Fischoeder, 1901), *Orthocoelium parvipapillatum* (Stiles & Goldberger, 1910), *Paramphistomum epiclitum*, Fischoeder, 1904, *Paramphistomum ichikawai*, Fukui, 1922, *Explanatum explanatum* (Creplin, 1847) and *Calicophoron calicophorum* (Fischoeder, 1901). Six of them, *G. crumenifer, C. spatiosus, O. streptocoelium, O. dicranocoelium, Paramphistomum epiclitum* and *P. ichikawai* are new locality records.
Key words: Amphistomes, Gastrothylacidae, Paramphistomidae, cattle, buffalo, Thailand

The first amphistome species described from Thai ruminants were probably *Paramphistomum siamense* Stiles & Goldberger, 1910 and *Fischoederius siamensis* Stiles & Goldberger, 1910, now they are regarded as synonyms of *Explanatum explanatum* (Creplin, 1847) and *Fischoederius elongatus* (Poirier, 1883) respectively. Later, Railliet (1924) described *Paramphistomum* (= *Orthocoelium*) *parvipapillatum* Stiles & Goldberger, 1910 from cattle. Recently, Lee & Lowe (1971) recovered *F. elongatus, F. cobboldi* and *O. orthocoelium* (Fischoeder, 1901) from cattle and buffalo. More recently, Eduardo (1983) found *Calicophoron calicophorum* in Thai cattle.

Identification of the species was based upon the structure of the muscular organs (acetabulum, terminal genitalium, pharynx) outlined by Näsmark (1937), Eduardo (1982, 1983) and Sey (1991). Due to their taxonomic value the structure of these organs is illustrated.

Materials and Methods

The test material was collected by one of us (P.P.) in abattoirs of Bangkok and Singkuri Province, Thailand. After removal from the rumen and the bile ducts the flukes were treated with saline and put immediately into fixative solution (70% alcohol). Whole mounts as well as histological sections were prepared as described elsewhere (Sey 1991). All measurements are in mm.

Results and Discussion

The amphistomes species obtained from the present collection belong to the families: Gastrothylacidae Stiles & Goldberger, 1910 and Paramphistomidae Fischoeder, 1901. Species of these two families are easily differentiated by the presence (Gastrothylacidae) or absence (Paramphistomidae) of the ventral pouch.

Gastrothylacidae Stiles & Goldberger, 1910

Key to the genera of Gastrothylacidae

1. Uterus and vas deferens cross over near middle — *Gastrothylax*
   Uterus and vas deferens in dorsal median line along their length — 2
2. Testes horizontal, one on each side of median line — *Carmyerius*
   Testes not horizontal, median — *Fischoederius*

Gastrothylax crumenifer (Creplin, 1847) (Figs 1, 7, 12)

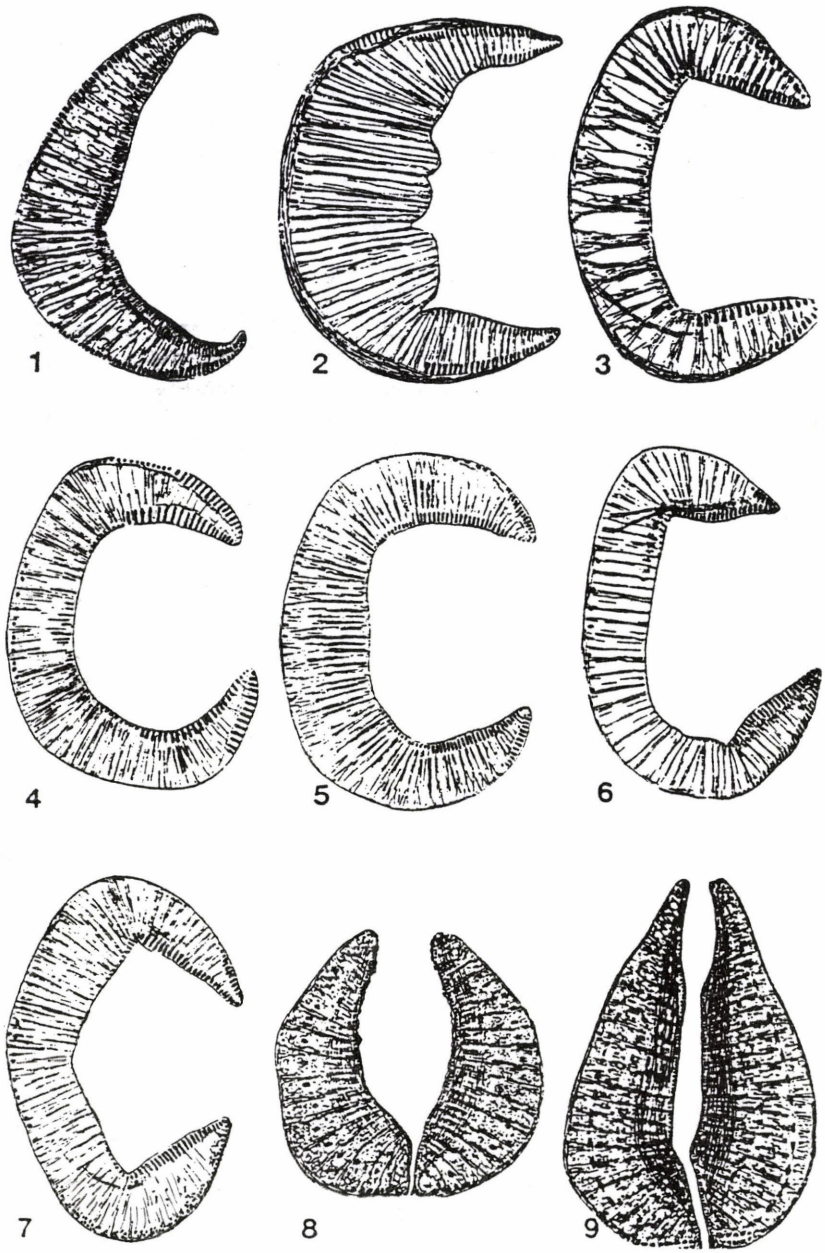
Diagnosis: Body length 10.7-16.3, body width 5.3-8.7.
Acetabulum 1.2 by 2.3 in size, *Gastrothylax* type (Fig. 1), number of muscle units: d.e.c. 98-147, d.i.c. 100-113, v.e.c. 103-114, v.i.c. 108-121, m.e.c. 10-14. Ventral pouch usually triangular in cross section with dorsally directed apex. Pharynx *Paramphistomum* type (Fig. 8), oesophagus 1.1-1.3. Testes 1.2.-1.3 by 0.5-0.6. Pars prostatica moderately developed. Ovary 0.2.-0.3 in diameter. Terminal genitalium opens into ventral pouch, *Gracile* type (Fig. 12.). Eggs 0.12-0.14 by 0.05-0.07.
Hosts: *Bos primigenius* f. *taurus*, *Bubalus arnee* f. *bubalis*.
Habitat: rumen.

Carmyerius spatiosus (Brandes, 1898) (Figs 1, 8, 12)

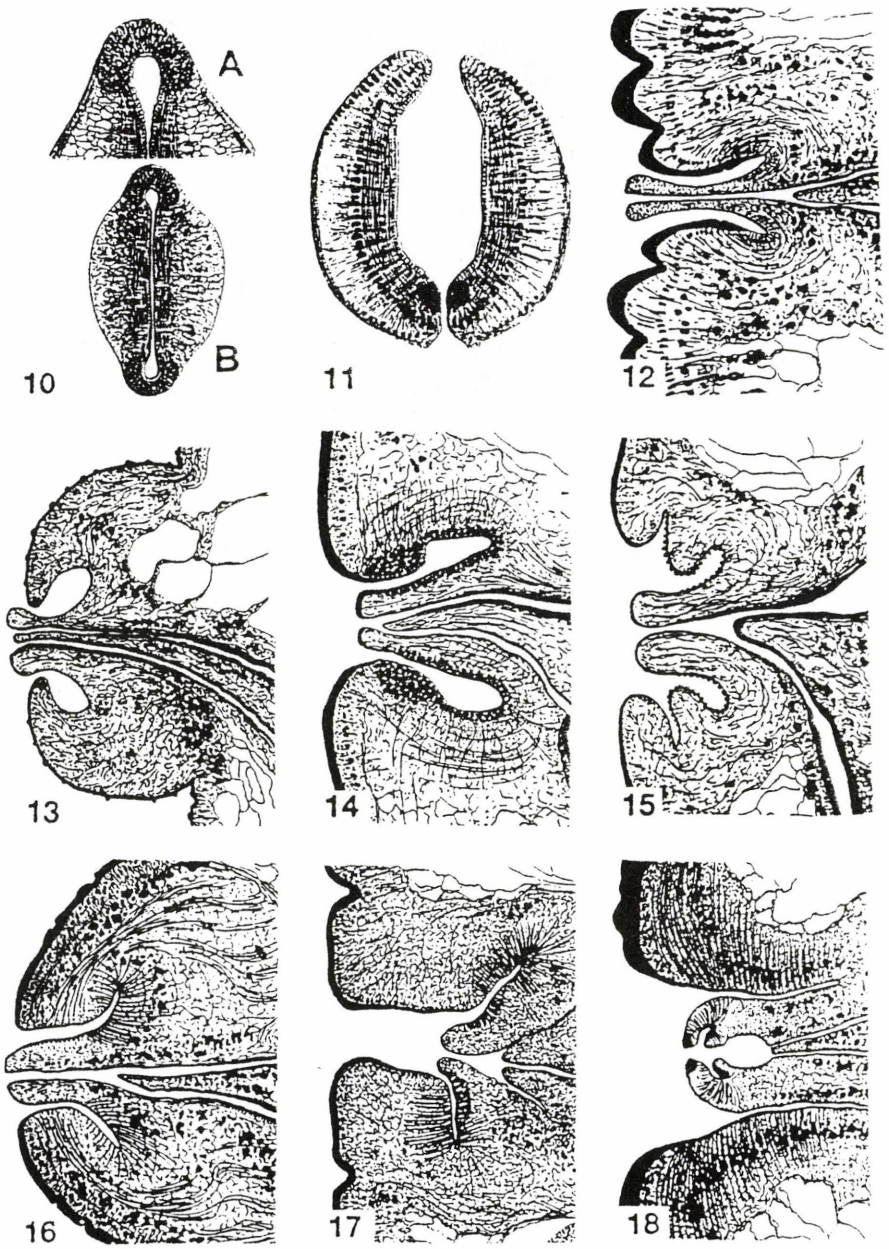
Diagnosis: Body length 8.7-11.2, body width 2.3-3.0.
Acetabulum 1.2-1.3 by 1.0-1.2, *Gastrothylax* type (Fig. 1), number of muscle units: d.e.c. 66-69, d.i.c. 40-44, v.e.c. 45-48, m.e.c. 6-7. Ventral pouch either circular or triangular with blunt angles. Pharynx 0.5-0.7 by 0.4-0.6, *Paramphistomum* type (Fig. 8), oesophagus 0.2-0.3. Pars musculosa weakly developed. Ovary 0.2-0.3 in diameter. Terminal genitalium within ventral pouch, *Gracile* type (Fig. 12). Eggs 0.1-0.2 by 0.06-0.07.
Host: *Bos primigenius* f. *taurus*.
Habitat: rumen.

Fischoederius elongatus (Poirier, 1883) (Figs 2, 8, 13)

Diagnosis: Body length 3.2-20.1, body width 1.6-3.2.
Acetabulum 1.2-1.3 in diameter, *Fischoederius* type (Fig. 2), number of muscle units; d.e.c. 42-46 + 9-11, d.i.c. 36-41, v.e.c. 50-53, v.i.c. 56-61, m.e.c. 16-19. Ventral pouch usually triangular with ventrally directed apex. Pharynx 0.5-0.7 by 0.02-0.5, *Paramphistomum* type (Fig. 8), oesophagus 0.5-0.8. Testes 0.7-1.1 in diameter. Pars musculosa moderately developed. Ovary 0.1-0.3 by 0.2-0.4. Terminal genitalium within ventral pouch, *Elongatus* type (Fig. 13). Eggs 0.11-0.13 by 0.05-0.07.
Hosts: *Bos primigenius* f. *taurus*, *Bubalus arnee* f. *bubalis*.
Habitat: rumen.



Figs 1-7. Median sagittal sections of acetabulum. *1* = *Gastrothylax* type; 2 = *Fischoederius* type; 3 = *Streptocoelium* type; 4 = *Paramphistomum* type; 5 = *Pisum* type; 6 = *Explanatum* type; 7 = *Calicophoron* type
Figs 8-9. Median sagittal sections of pharynx. 8 = *Paramphistomum* type; 9 = *Calicophoron* type



Figs 10-11. 10.= *Dicranocoelium* type (A and B cross sections with lip sphincter)
11= *Explanatum* type
Figs 12-18. Median sagittal sections of terminal genitalium. 12 = *Gracile* type; 13 = *Elongatum* type; 14 = *Streptocoelium* type; 15 = *Parvipapillatum* type; 16 = *Epiclitum* type; 17 = *Ichikawai* type; 18 = *Calicophoron* type

Paramphistomidae Fischoeder, 1901

Key to the genera of Paramphistomidae

1. Excretory duct and Laurer's canal cross each other — 2
   Excretory duct and Laurer's canal without crossing — *Orthocoelium*
2. Pars musculosa weakly developed — 3
   Pars musculosa strongly developed — *Calicophoron*
3. Acetabulum *Explanatum* type — *Explanatum*
   Acetabulum *Paramphistomum* or *Pisum* type — *Paramphistomum*

Orthocoelium streptocoelium (Fischoeder, 1901) (Figs 3, 9, 14)

Diagnosis: Body length 4.2-9.3, body width 1.0-2.3.
Acetabulum 0.8-1.4 in diameter, *Streptocoelium* type (Fig. 3), muscle units: d.e.c. 16-21, d.i.c. 20-26, v.e.c. 15-20, v.i.c. 20-23, m.e.c. 4-7. Pharynx 0.3-0.9, *Calicophoron* type (Fig. 9), oesophagus 0.4-1.2, with muscular sphincter. Anterior testis 0.4-0.7 long and 0.6-0.9 in dorsoventral direction, posterior testis 0.2-0.6 long and 0.4-0.8 in dorsoventral direction. Pars musculosa well developed. Ovary 0.2-0.5 in diameter. Terminal genitalium *Streptocoelium* type (Fig. 14), genital pore postbifurcal. Eggs 0.11-0.14 by 0.05-0.07.
Hosts: *Bos primigenius* f. *taurus*, *Bubalus arnee* f. *bubalis*.
Habitat: rumen.

Orthocoelium dicranocoelium (Fischoeder, 1901) (Figs 3, 10A, 10B, 12)

Diagnosis Body length 4.1-7.1, body width 1.1-2.2.
Acetabulum 0.5-1.1 in diameter, *Streptocoelium* type (Fig. 3), number of muscle units: d.e.c. 11-16, d.i.c. 18-26, v.e.c. 11-17, v.i.c. 18-26, m.e.c. 5-7. Pharynx 0.3-0.8 long, *Dicranocoelium* type (Figs 10A, 10B), oesophagus 0.3-1.1 long with muscular thickening. Anterior testis 0.6-1.2 long and 0.5-1.1 in dorsoventral direction, posterior testis 0.7-1.2 long and 0.5-1.2 in dorsoventral direction. Ovary 0.2-0.4 in diameter. Terminal genitalium *Gracile* type (Fig. 12), genital pore postbifurcal, pars musculosa well developed. Eggs 0.11-0.13 by 0.06-0.09.
Hosts: *Bos primigenius* f. *taurus*.
Habitat: rumen.

Orthocoelium parvipapillatum (Stiles & Goldberger, 1910) (Figs 3, 10A, 10B, 15)

Diagnosis. Body length 2.4-3.6, body width 1.0-2.1.
Acetabulum 0.4-0.8, *Streptocoelium* type (Fig. 3), number of muscle units: d.e.c. 13-17, d.i.c. 20-24, v.e.c. 10-17, v.i.c.20-24, m.e.c. 3-7. Pharynx 0.3-0.5 long, *Dicranocoelium* type (Figs 10A, 10B), oesophagus 0.4-0.7 long. Anterior testis 0.3-0.5 long and 0.4-0.6 in dorsoventral direction. Pars musculosa moderately developed. Ovary 0.1-0.2 by 0.2-0.3. Terminal genitalium *Parvipapillatum* type (Fig. 15), genital pore postbifurcal. Eggs 0.12-0.14 by 0.061-0.07.
Host: *Bos primigenius* f. *taurus*.
Habitat: rumen.

Key to the species of *Orthocoelium*

1. Pharynx *Dicranocoelium* type — 2
   Pharynx *Calicophoron* type — *O. streptocoelium*
2. Terminal genitalium *Gracile* type — *O. dicranocoelium*
   Terminal genitalium *Parvipapillatum* type — *O. parvipapillatum*

Paramphistomum epiclitum Fischoeder, 1904 (Figs 4, 9, 16)

Diagnosis: Body length 5.8-8.2, body width 0.5-1.9 in dorsoventral direction. Acetabulum 0.7-1.5 in dorsoventral direction, *Paramphistomum* type (Fig. 4), number of muscle units: d.e.c.1, 9-23, d.e.c.2, 20-38, d.i.c. 24-51, v.e.c. 8-18, v.i.c. 25-61, m.e.c. 16-22. Pharynx 0.5-9.2 long, *Calicophoron* type (Fig. 9), without muscular thickening. Anterior testis 0.3-0.8 long and 0.5-1.2 in dorsoventral direction; posterior testis 0.6-1.2 long and 1.1-1.4 in dorsoventral direction, pars musculosa short, weakly developed. Ovary 0.2-0.3 by 0.2-0.3. Terminal genitalium *Epiclitum* type (Fig. 16). Genital pore postbifurcal. Eggs 0.13-0.15 by 0.06-0.08
Host: *Bos primigenius* f. *taurus.*
Habitat: rumen.

Paramphistomum ichikawai Fukui, 1922 (Figs 5, 9, 17)

Diagnosis: Body length 4.1-8.7, body width 1.3-2.7 in dorsoventral direction. Diameter of acetabulum 0.7-1.3 in dorsoventral direction, *Pisum* type (Fig. 5), number of muscle units: d.e.c.1, 18-20, d.e.c.2, 5-14, d.i.c. 30-58, v.e.c. 14-26, v.i.c. 30-58, m.e.c. 10-16. Pharynx 0.4-0.8, *Calicophoron* type (Fig. 9), oesophagus 0.3-1.7 long without muscular thickening. Anterior testis 0.3-0.9 long and 0.6-1.5 in dorsoventral direction; posterior testis 0.3-1.7 long and 1.1-1.8 in dorsoventral direction. Pars musculosa short and weakly developed. Ovary 0.2-0.4 by 0.4-0.5. Terminal genitalium *Ichikawai* type (Fig. 17). Genital pore postbifurcal. Eggs 0.1-1.2 by 0.05-0.07.
Host: *Bos primigenius* f. *taurus.*
Habitat: rumen.

Key to the species of *Paramphistomum*

1. Terminal genitalium *Epiclitum* type — *P. epiclitum*

   Terminal genitalium *Ichikawai* type — *P. ichikawai*

Explanatum explanatum (Creplin, 1847) (Figs 6, 11)

Diagnosis: Body length 6.1-12.1, body width 3.1-6.2 in dorsoventral direction. Acetabulum enormous, 3.1-4.2 in diameter, *Explanatum* type (Fig. 6), number of muscle units: d.e.c.1, 8-13, d.e.c.2, 16-31, d.i.c. 36-44, v.e.c. 9-12, v.i.c. 24-43, m.e.c. 3-7. Pharynx 0.6-0.8 long, *Explanatum* type (Fig. 11), oesophagus 0.6-0.9 long. Anterior testis 1.0-1.5 long and 1.2-2.4 in dorsoventral direction. Ovary 0.3-0.6 by 0.4-0.5. Pars musculosa short and weakly developed. Terminal genitalium *Explanatum* type. Genital pore bifurcal. Eggs 0.11-0.12 by 0.07-0.08.
Host: *Bubalus arnee* f. *bubalis.*
Habitat: bile ducts.

Calicophoron calicophorum (Fischoeder, 1901) (Figs 7, 9, 18)

Diagnosis: Body length 7.5-14.8, body width 3.1-3.9.
Acetabulum 1.1-3.2, *Calicophoron* type (Fig. 7), number of muscle units: d.e.c. 9-12, d.i.c. 32-39, v.e.c. and v.i.c. 16-21, m.e.c. 7-13. Pharynx 0.5-1.9, *Calicophoron* type (Fig. 9), oesophagus 0.5-1.3, without muscular thickening. Anterior testis 0.9-4.1 long and 1.2-4.3 in dorsoventral direction, posterior testis 1.0-4.1 long and 1.3-4.2 in dorsoventral direction. Pars musculosa well developed, strongly convoluted. Ovary 0.4-1.3 by 0.6-1.4. Terminal genitalium *Calicophoron* type (Fig.18). Genital pore postbifurcal. Eggs 0.11-0.15 by 0.06-0.09.
Hosts: *Bos primigenius* f. *taurus*, *Bubalus arnee* f. *bubalis.*
Habitat: rumen.

The species composition found in Thai ruminants is more or less similar to that of the neighbouring countries (e.g. Burma, Cambodia). Further examinations extended to other parts of the country and involved other than domestic ruminants, supposedly, will reveal more and other species than the presently recovered ones. The gross- and histomorphological variabilities of the species in question are within the limits given in standard literary data.

Although some of the recovered species are new locality records for this country, nevertheless all of these species are found in the Malayan realm (Sey 1991)

Life-cycle of these species have not yet been studied in Thailand, although the developmental biology of the major part of these species has already been described outside this country. It seems to be the most promising area for the further research contributing to the better understanding of the epidemiology of these amphistomes in Thailand.

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